FISH BEHAVIOR

All fishing practices depend upon some knowledge of the behavior of the particular species being sought. This knowledge is now mainly a collection of observations of fishermen and naturalists over the centuries. It is long past time that a serious quantitative investigation be made of the factors which influence aggregation, vertical distribution, seasonal migration, feeding cycles, changes in availability, escape from gear, and other aspects of the behavior of fishes.

42/6/L TrL#

SUPERING OF SCHEDULE

Investigation: Fish Behavior Biological Laboratory: Woods Hole, Mass.

		Est.*				Fi	Fiscal	Years				
	Project Title	Cost	125	28	59	09		62 6	9 69	59 179	99 } 5	<u> </u>
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			[6]	Di.	Lab. Director		Herbert		Graham	am 8/6/59	65/	
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U. S. Fish and Wildlife Service Bureau of Commercial Fisheries

Sheet No. 1

Lecation: Woods Hole, Mass. Date: August 6, 1959
File No.

Research Project Outline

	when delighed in a selection of the control of the
Title of Project:	The behavior of groundfish in the cod end of otter trawls.
Investigation Titl	
Investigation Chie	f: R. Livingstone, Jr.
Project Landar:	R. Livingstone, Jr., Fishery Research Biologist GS-9
: Assistants: (Titl	
Cellaboraters:	
No. J. Com. To. Com.	
escapement i escapement e	on: Gear selection experiments have shown differential or different sizes of fish. From variations in these experiments it is plain that escapement is not an active avior. Observations are needed as to the mechanism
of escape.	2012010 Obdat vacions are needed as 50 one mechanism
Objective • m	

Objective: To determine the factors effecting the escapement of different species of groundfish.

Method of Procedure: UWTV in cod end. Observe reactions of fish to towing speed, size of catch, species composition, etc. Completed.

Phase 1: To analyze films of monitor, record and describe behavior.

Phase 2:

Shoet No. 2

File No.:

Method of Procedure: (Cont'd)

Phase 3:

Estimated Costs: Tota	l Needed by Labora	tory for Complete Project	23•6
	FY <u>1959</u>	FY <u>1960</u>	FY 1961
Personal Services	3.8	2.8	
Other Expenses: Within Project	0.3	0.1	City On
Lab. Adm. & Ser.	8.1	8.5	
Lab. Total	12.2	11.4	
Regional Office Washington Office		.114	errorina de la compania de la compa
Total			The companion of the control of the
Recommended Source of F	(nd Regular S-K, Regular, Contributed, Phase 2 M ; Phase 3 M	·
Recommended by:	vingstone, Jr.	; Frace 2 : 1 ; Frace 5 F1	;Froject_FY 60
Investigation Chief	Robert Livingstone	e. Jr.	8/6/59
Laboratory Director	Herbert V. Grahem		8/6/59
Regional Director	Joseph 4 Ve	iner la	8/19/59
Promph Chief Approved by:	2/HE		12-24-59
Apparated by: Division Chief for Dir	rector // 1971		

Remarks

U. S. Fish and Wildlife Service Bureau of Commercial Fisherics

Sheet No. 1

Location: Woods Hole, Mass. Date: August 6, 1959 File Ne.

Research Project Outline

		The second secon	
Title of Proj	oct: <u>Depth-temperature</u>	for use with underwate	er television systems.
Investigation	Title: Fish Behavior	rikanikan estilah mangapakan mangapakan mangapakan mangapak mangapakan	
Investigation	Chief: R. Livingstone,	Jr.	
Project Loads:	r: R. Livingstone	, Jr. Fishery Research	Biologist GS-9
	Name	Title	Gr ade
Assistants:	(Title and Grade)		
Collaborators	•		
net or : depths, measuri	rmation: In order to ev in the environment, it currents, etc. Instru ng these variables in c fulness of UTV would be	is necessary to conside mentation needed to be onjunction with visual	der temperatures, e developed for
Objective: 10 etc., in	develop instruments fon conjunction with UTV	r measuring temperatur observations.	re, depth, current,
Method of Proc	cedure:		

To present the idea to WHOI and enlist their services to design and fabricate a single conductor telemeter that would transmit temperature and depth information through the television cable.

Phase 2: Test under field conditions. Sheet No. 2

File No.:

Method of Procedure: (Cont'd)

Phase 3:

Estimated Costs: Tota	l Needed by Labora	tory for Complete Project	21.8
	FY <u>1959</u>	FY <u>1960</u>	FY 1961
Personal Services	2.0	2.8	
Other Expenses: Within Project	0.2	0.1	
Lab. Adm. & Ser.	8.]	8.6	. Maritim, erikati paramilikakan kan angan
Lab. Total	10.3	11.5	
Regional Office Washington Office	103	.115	and the second s
Total		MECHANISM TEV VALUE and Adjust adapting	haliffina eministratura e a a en e e e e e e e e e e e e e e e
Recommended Source of F	(S-K and Regular S-K, Regular, Contributed,	·
Estimated Date of Comple	etion: Phase 1 FY	59; Phase 2 FY; Phase 3 F	Project IY 60
Recommended by: Craginator R.L.I	itingstone, Jr		8/6/59 Date
Investigation Chief	Robert Livingston	r, Jr.	8/6/59
Laboratory Director	Herbert W. Graham		8/6/59
Regional Director	Joseph & Per	ventur	8/19/59
Branch Chief	1 HAE.		12-24-59
Approved by: Division Chief for Dir	rector Mars 17	/	fred ton

Remarks

U. S. Fish and Wildlife Service Bureau of Commercial Fisheries

Sheet Mo. 1

Location: Woods Hole, Mass. Date: August 6, 1959 File Ne.

Research Project Outline

managed energy region and the contract of the
Title of Project: Orientation of bottom fish with reference to a current and light
Investigation Title: Fish Behavior
Investigation Chief: R. Liwingstone, Jr.
Project Leader: R. Livingstone, Jr. Fishery Research Biologist GS-9
Assistants: (Title and Grade)
Collaborators:
Need for Information: Many species of groundfish have been observed to orient upstream in the cod end of otter trawls. If facing into the current is common also in nature, then one would expect wide variations in the catch of groundfish in short intervals of space and time. Observations on orientations to a current are necessary in order to understand this behavior and more fully appreciate efficiency of gear.
Objective: To determine if bottomfish orient with reference to tidal and other currents, light, etc.
Method of Procedure: Observations of behavior and orientation of groundfish in

the laboratory followed by experiments in the field using TV Phase 1: and/or divers.

Phase 2:

Shcet No. 2

Filc No.:

Method of Procedure: (Cont'd)

Phase 3:

Estimated Costs: Total Needed by	y Laboratory for Complete Pro	oject 110.4
FY <u>1959</u>	FY 1960	FY <u>1961</u>
Personal Services Other Expenses: Within Project		1.9
Lab. Adm. & Ser.		0_3
Lab. Total		5.8 8.0
Regional Office Washington Office		• 08
Total		disdiminaremental over 10 steps strong 10 - 25 stage, 17 pag
Recommended Source of Funds	S-K and Regular (S-K, Regular, Contrib	outed, etc.)
Estimated Date of Completion: Phase	se l FY 61 ; Phase 2 FY ; Phas	e 3 FY ;Project FY 65
Recommended by: Caiginator R. L. Livingston	ı, Jr.	<u>Date</u> 8/6/59
Investigation Chief Robert Liv	ingstone, Jr.	8/6/59
Laboratory Director Herbert W.	Graham	8/6/59
Regional Director fresh	Puniochan	8/19/59
Errnch Chief	2444.	12-24-59
Approved by: Division Chief for Director/	No A	and be

Remarks

U. S. Fish and Wildlife Service Bureau of Commercial Fisherics

Sheet No. 1

Location: Woods Hole, Mass. Date: August 6, 1959
File No.

Research Project Outline

Investigation Title: Fish Behavior Investigation Chief: R. Livingstone, Jr. Project Leader: R. Livingston, Jr. Fishery Research Biologist GS- Name Title Grade Assistants: (Title and Grade)	Title of Proj	ect: Di	ırnal N	digrations	of: (scup, but	terfish,	hakes)
Project Loader: R. Livingston, Jr. Fishery Research Biologist GS-Name Title Grade	Investigati on	Title:	Fish F	Behavior		······································	بمسيونية بإشارينية ، التشارينية	
Nome Title Grade	Investigation	Chief:	R. Liv	ringstone,	Jr.			
, and the state of	Project Landa	r:	R. I	ivingston,	Jr.		Research	Biologist GS-9
Assistants: (Title and Grade)			Nome			$\mathtt{Titl}e$		Gr ade
,,	Assistants:	(Title	and Gra	ide)				
	ollaborators	•						

Need for Information: Commercial fishermen have learned to adjust their fishing to habits in accord with the diurnal changes in availability of fish. Fishery biologists know little about the mechanism of diurnal behavior in fishes. A study of the factors involved would be of great us to the New England fishing industry which is currently interested in the possibility of midwater fisheries.

Objective: To investigate the factors governing the diurnal behavior of scup, etc.

Method of Procedure:

- Phase 1: To observe by means of remote UTV the behavior of scup, etc., in an enclosure at intervals over a 24 hour period. Record changes in orientation and behavior (currents, rate of swimming, feeding behavior, schooling, etc.)
- Phase 2: Attempt a similar series of observations on a larger scale in the field using echo sounding, TV and mid water trawls.

Shcet No. 2

Filc No.:

Method of Procedure: (Cont'd)

Phase 3:

Estimated Costs: Total Neede	d by Laboratory	for Complete Proje	ct <u>30•7</u>
FY <u>]</u>	L959	FY <u>1960</u>	FY 1961
Personal ServicesOther Expenses:	·		2,0
Within Project	***************************************		0.4
Lab, Adm. & Ser			5.7
Lab. Total			8.1
Regional Office Vashington Office		and the same of th	.081
Total	**************************************		and the analysis and a success of the success of th
Recommended Source of Funds Estimated Date of Completion:		Regular, Contribut	•
Recommended by: Criginator R. L. Livings		iase Z FI ; Filase	8/6/59 Date
Investigation Chief Robert I	ivingstone. Jr.		8/6/59
Laboratory Director Herbert			8/6/59
Regional Director	Mi G. Pun	ortion	8/19/59
Branch Chief / Approved by:	SHE.		12-24-57
Division Chief for Director	MAHA		<u> </u>

Remarks

U. S. Fish and Wildlife Service Bureau of Commercial Fisherics

Sheet No. 1

Location: Woods Hole, Mass. Date: August 6, 1959
File No.

Research Project Outline

itle of Project: <u>F</u> haddock an nvestigation Ti t le	d other groundfis	atus for test	ing swimmai	ing speed f	or
nvestigation Chief	R. Livingstone,	Jro			-
roject Leader:	R. Livingstone		Re search		
	Маше	$\mathtt{Titl}_{\mathbb{C}}$		GI	ade
ollaberators:					
TIADORA COLS:					
eed for Information	Research with	television in	trawl net	s has show	n that
resultant activ	e net over the bo ities of fish in for testing their	ttom has a pro the cod end. swimming abil	onounced e Facilitie Lities mus	effect on the es for hold	he ing

Objective: To develop apparatus for measuring swimming speed of groundfish.

speed on mechanism of escapement.

Method of Procedure: Design and test experimental apparatus in laboratory or field such as fish wheel, flume, TV rheotaxis cage, etc. Test fish of various sizes and observe their reactions to experimental apparatus.

Phase 2:

Sheet No. 2

File No.:

Method of Procedure: (Cont'd)

Phase 3:

Estimated Costs: Total	. Needed by Laborat	ory for Complete Project	30.L
·	FY <u>1959</u>	FY <u>1960</u>	FY 1961
Personal Services Other Expenses: Within Project			0.3
Lab. Adm. & Ser.		distriction and the second second section as a second second section of the second section sec	5.8
Lab. Total			8.0
Regional Office Washington Office			.08
Total			व्यवस्थितं वर्षात्रे
Recommended Source of Fu		nd Regular -K, Regular, Contributed	, ∈tc _c)
Estimated Date of Comple	tion: Phase 1 FY 6	L;Phase 2 FY ;Phase 3	FY ;Project FY 63
Recommended by:	obert Livingstone,		<u>Date</u> 8/6/59
Investigation Chief	Robert Li	vingstone. Jr.	8/6/59
Laboratory Director	Herbert W		8/6/59
Regional Director	Sperk 7.	Region Even	8/19/59
Branch Chief	240	18	12-24-59
Approved by: Division Chief for Dire	ector	H	1.1.1.10

Remarks